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ABSTRACT

This study observed the spatial distribution of activity in a second-third grade informal classroom and tested the general hypothesis that changes in the physical setting could produce changes in students' behavior. The experimenter observed for two weeks, using a time-sampling-by-child instrument. The activities and locations of the subjects were recorded on a floor plan of the room. Design postchange observation period was begun. The statistical significance of the behavioral changes produced was demonstrated by time-series analysis. (Author)

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THE EFFECT OF A CHANGE IN THE PHYSICAL DESIGN OF AN OPEN CLASSROOM ON STUDENT BEHAVIOR[1]

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Until recently, behavioral scientists discussed the environmental determinants of behavior in social and cultural terms only, regarding the physical setting as a relatively insignificant backdrop (Wohlwill, 1970). Almost all analyses of social institutions have been based on the implicit or explicit assumption that man acts on environment, organizing, manipulating, and changing it to meet his needs and desires. From this point of view, the important factors in explaining behavior are interpersonal: given the same cast of people, behavior will tend to be the same even in a different setting.

This perspective is gradually changing. There is a new awareness that the physical setting does not serve merely as a static context for behavior, but rather that there exists a dynamic relationship between man and his physical world. Researchers have investigated spatial patterns of behavior in children's psychiatric hospitals (Rivlin and Wolfe, 1972), juvenile treatment centers (Hahn, 1973), dormitories (Heilweill, 1973), psychiatric wards (Esser, Chamberlain, Chapple, and Kline, 1970; Gump and James, 1970; Ittelson, Proshansky, and Rivlin, 1970) and libraries (Eastman and Harper, 1971; Sommer, 1966). Others have focused on the effects of specific physical features: the absence of windows (Karmel, 1965; Myers, Johnson, and Smith, 1968), temperature-density (Griffit and Veitch, 1971; Rohles, 1967), aesthetic quality (Maslow and Mintz, 1956; Mintz, 1956), and furniture arrangements and interior design (Brookes and Kaplan, 1972; Sommer, 1969; Sommer and

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and Ross, 1958).

In education, the growing popularity of informal or open classrooms has given further impetus to the consideration of physical variables. In contrast to a traditional classroom, the environment of a well-planned open classroom is intended to be flexible; the teacher can readily change it in response to the children's needs and concerns. The space is usually divided into a number of interest areas where children can work alone or in groups. Typically, there are areas for quiet reading and writing, mathematics, science, and crafts; there may also be places for cooking, printing, dramatic play, stores, discussion, and music. Children are free to move from one area to another as they wish. Materials and equipment are displayed on open, accessible shelves to encourage responsibility and self-sufficiency.

The amount of time and effort the teacher in an open classroom devotes to structuring the physical environment reflects the conviction that it is a powerful factor in the success of the instructional program. The validity of this belief, however, has not been empirically demonstrated, although a few studies have lent it support. Prescott, Jones, and Kritchevsky (1967) studied the programs offered by Los Angeles day care centers. During their observations of teacher and child behavior, the investigators noted tremendous variety in the design of play areas. They hypothesized that much of the children's activity was determined by the materials and equipment that were available and how they were arranged. More systematic observations led to the conclusion that these physical features were among the most effective predictors of program quality (Kritchevsky and Prescott, 1969). Specifically, the observers noted that as the quality of space decreased, the amount of teacher restriction and control increased, the teacher's manner appeared less friendly and sensitive while the children seemed less interested, and

conflict among children rose.

Zifferblatt (1972) is one of the few investigators to have examined the relationship between design and behavior in open classrooms. He compared two third-grade rooms in which the teachers' instructional styles, the curricula, and the activities were very similar. Yet in one classroom, he observed shorter attention spans, a great deal of non-task-oriented movement, and loud conversation. Zifferblatt concluded that the behavioral differences were due to the way the space was arranged in each room. Unfortunately, he does not explain how his observations were conducted, nor is any statistical analysis presented. Furthermore, it is not clear that the matching was entirely effective in controlling all the differences that can exist between two rooms.

The major goals of the present study were 1) to develop an observation technique and a category system appropriate for use in examining the relationship between space and behavior in an open classroom; 2) to observe and record systematically the spatial distribution of activity in such a room; and 3) to investigate the effects of a change in the physical design of the classroom on the students' behavior. Because of the exploratory nature of the study, only one classroom was selected for observation. The general plan was to observe the behavior in this classroom before and after a change in the physical layout of the room.

Method

Subjects and Setting

The subjects of the study were 25 second and third graders in a self-contained informal classroom which the teacher had divided into five "subject matter" areas: mathematics, reading, games, art, and science. There were also two areas of the room referred to as the "file area," which contained the teacher's table and filing cabinet and two student desks, and the "corner," in which a small table and a student

desk were located. A floor plan of the room appears in Figure 1.

With the exception of the first hour in the morning, when the children were required to do some aspect of language arts, they worked on assignments and independent activities which they selected. There were no assigned seats and the children could choose where they wished to work. Activities in each area of the room were not confined to the subject matters for which the areas were named. In other words, math work could occur anywhere in the classroom; the designation "math area" merely reflected the location of the math materials.

The teacher spent the majority of the day meeting with individuals and small groups to introduce lessons and activities and to check on academic progress. Generally, after she had seen all the students who were scheduled to meet with her on a particular day, or who needed her help, she played games with various children and circulated around the room commenting on the ongoing activities.

Behavioral Categories

Categories derived from the experimenter's own observations were combined with others adapted from a system devised by researchers in the Environmental Psychology program at City University of New York. The final set of 48 categories reflects the decision to confine the categories to common sense, overt behaviors. No attempt was made to code the intention of the pupils. Thus, if a pupil was seen talking to the teacher, it was coded simply as talking, rather than in a somewhat more inferential manner, such as "seeking adult approval." In addition, activities were not categorized according to subject matter. A child working with manipulative materials such as geoboards or a math balance was coded as "manipulating an object" rather than doing math.

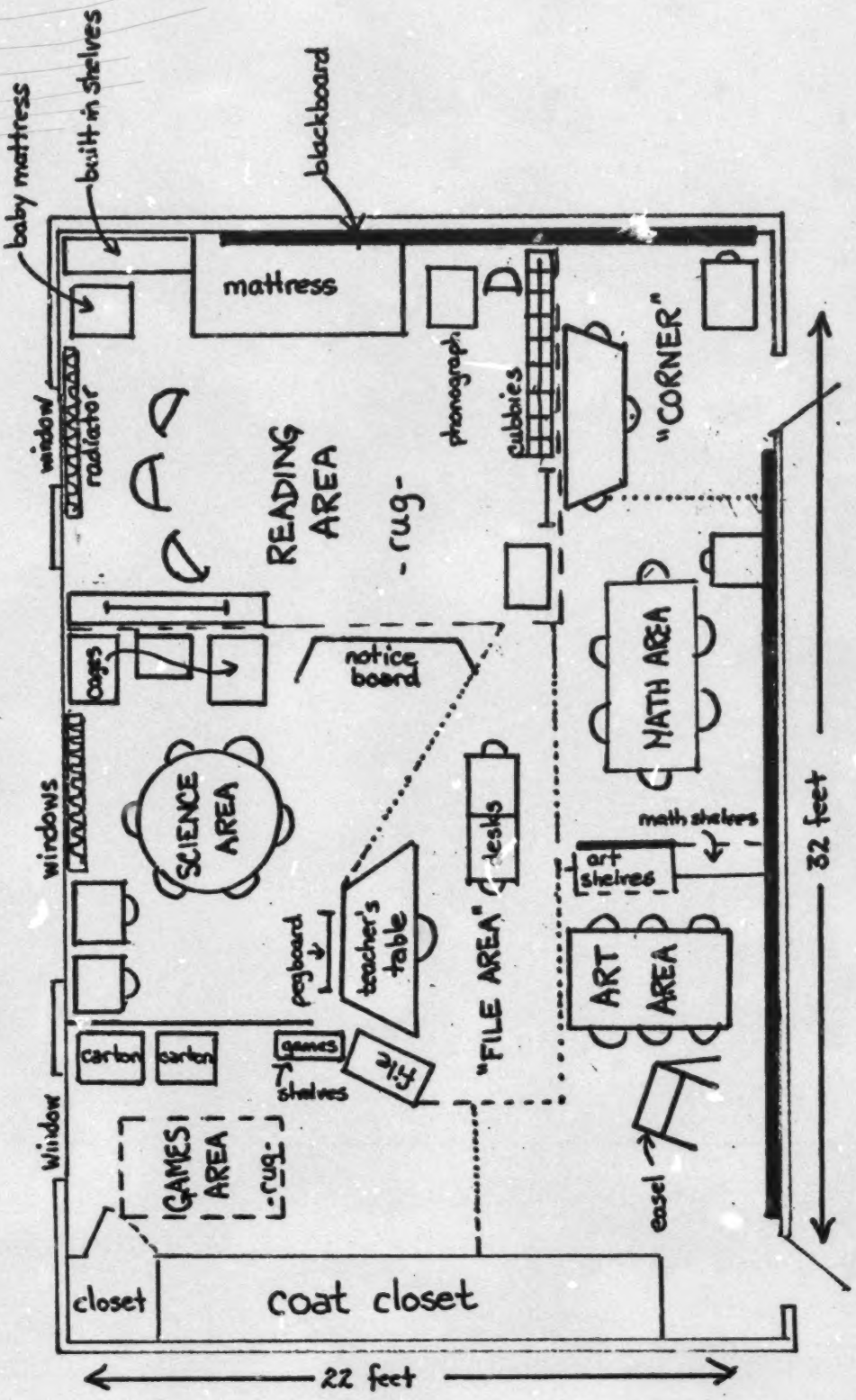


Figure 1: Pre-Change Floor Plan

Observational Technique

The observation technique developed in the study--time-sampling by child--is a form of behavioral mapping in which categories of behavior are related to the physical locations in which they occur. All members of the class were listed in alphabetical order and assigned a letter of the alphabet. At the scheduled moment, the observer entered the classroom and visually located Person A. She watched A's activities for a silent count of six seconds, and then coded, from memory, what A had been doing at the sixth second. The child's letter and the number of the category in which he was engaged were recorded on a floor plan of the room. The observer then found B and repeated the process. In this manner, she worked her way through the alphabet, left the room, and anecdotally recorded any additional information which she deemed pertinent. The whole procedure took nine or ten minutes and was conducted six times a day at 35-minute intervals whenever possible.[2] A sample coding sheet appears in Figure 2.

Inter-observer reliability checks were conducted both before and after the change in room arrangement. Reliability, defined as the percentage of items on which the experimenter and a research assistant agreed, averaged 91%.

Procedure

After the instruments had been developed and their reliability established, the experimenter administered a pre-change interview to the teacher, designed to find out the kinds of behavior she wished to foster in her students, her goals for the class, and the ways in which she saw the physical environment as facilitating or hindering the realization of these goals. The experimenter then observed the behavior in the classroom for two weeks. This constituted the pre-change observation period. At the end of this time, the students were interviewed individually

DATE 2-3-72
OBS. # 1
TIME 9:00-9:10
CENSUS 24

	B	G
HALL	0	0
ART	1	1
GAMES	0	0
FILE	3	1

	B	G
SCIENCE	1	1
READING	3	7
MATH	4	3,2
CORNER	0	0

OUT OF ROOM T

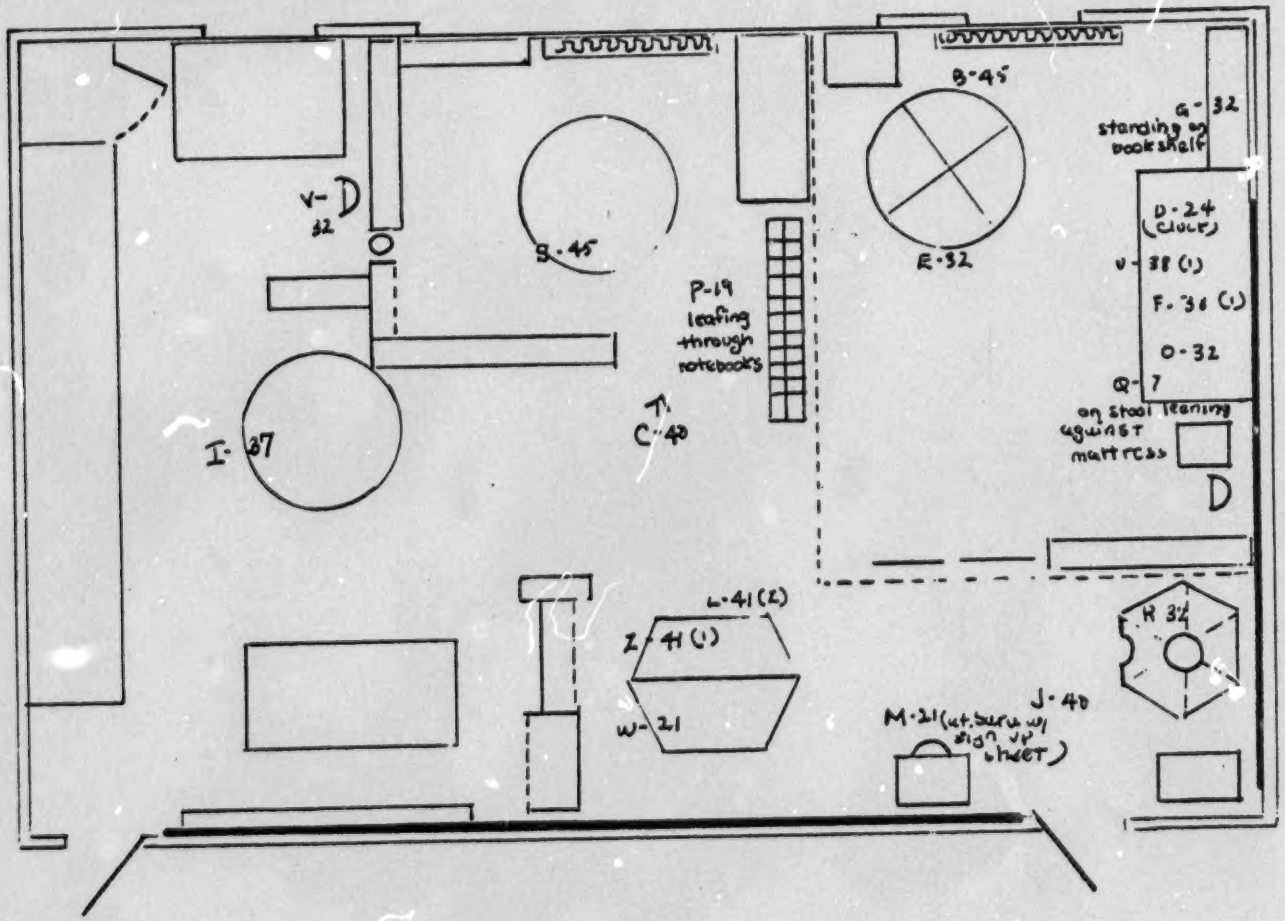


Figure 2: Time-Sampling Coding Sheet

about their reactions to the room arrangement.

The patterns of behavior which emerged from a preliminary analysis of the pre-change data were shared with the teacher, problems were identified, and possible changes in room arrangement were discussed. The experimenter alone decided upon the final room changes to be made and hypothesized about their possible effects on the children's behavior. These hypotheses were not revealed to the teacher.

All room changes were made during a three-day weekend. Changes were limited to the rearrangement and addition of furniture and to changes in color and general attractiveness of some areas. The relative locations and sizes of the areas remained essentially the same.

For three days after the students' return to school, informal, anecdotal records of their reactions were kept. On the fourth day, the experimenter resumed formal observations, which continued for two weeks. At the conclusion of this post-change observation period, final interviews were administered to the teacher and the students. A descriptive analysis of the post-change behavior was then conducted, and a statistical comparison made of the pre- and post-change time-sampling data.

Results and Interpretation

Pre-Change Period

The descriptive analysis of the data conducted at the conclusion of the pre-change period consisted of one- and two-way frequency distributions for most of the key variables--subject, sex, category of behavior, area of room, day of week, and time of day. Only the most important results will be discussed here.

Population frequencies for each area of the room were derived by combining the data from all ten days of observations. These figures are listed in the first two columns of Table 1. Since the distribution of children across the room might have been reflecting nothing more than

Table 1

AREA POPULATION FREQUENCIES

Area	Pre-Change			Post-Change			
	N*	%	Ideal %	N	%	Ideal ¢	Recalculated Ideal %
Reading	392	28.6	25.0	389	27.3	25.0	27.5
Mathematics	304	22.2	12.0	225	15.8	13.0	14.3
Art	203	14.8	13.0	236	16.5	14.0	15.4
Science	149	10.9	15.0	214	15.0	17.0	18.7
File	135	9.8	15.0	53	3.7	11.0	2.0
Games	110	8.0	13.0	247	17.3	14.0	15.4
Corner	59	4.3	7.0	61	4.3	6.0	6.6
		98.6**	100.0		99.9	100.0	

*the number of times a child was observed in an area

**the remaining percentage represents subjects who were working in the hallway.

the size of each area, an "ideal" distribution, based simply on square footage was calculated and is presented in the third column.

A comparison between these figures and the actual observed population percentages indicated that the relative size of the areas did not in itself account for the distribution of students. Both the science and the file areas were larger than the math and the art areas, but were used less frequently. In the case of the file area, this was not too surprising. The area contained the teacher's table and filing cabinet--two objects which the children did not often use--and only two desks. The area served primarily as a traffic lane. The science area, however, had a population frequency that seemed unusually low for its size. This was also true of the games area, which was as large as the art area and larger than the math area, but had a population much lower than either of these. The math area in particular seemed to be a very popular place.

The population frequencies of each area were also examined in relationship to sex. These results appear in the first two columns of Table 2. There is clearly a wide disparity between the boys' and girls' attendance in the games, science, and math areas.

Table 3 presents the categories of behavior observed most frequently across the room. Only those categories which were observed at least two times a day, on an average, are included here.

An "activity profile" for each area was also derived, listing the categories of behavior observed most frequently in each place. The pre-change activity profile for the reading area is presented in the first two columns of Table 4 as an example.

Room Changes and Hypotheses

An examination of the pre-change data revealed a number of problems with the way in which the classroom was being used. Three were particularly apparent. First, the population frequency distribution table

Table 2

AREA POPULATIONS BY SEX

Area	Pre-Change		Post Change	
	Males (%)	Females (%)	Males (%)	Females (%)
Art	15.9	14.0	12.8	19.6
Corner	3.3	4.7	2.8	5.5
File	10.9	9.1	4.2	3.3
Games	14.9	3.0	21.9	13.5
Mathematics	12.8	29.0	15.6	15.9
Reading	26.6	30.1	24.3	29.7
Science	14.0	8.6	18.2	12.3
	98.9*	98.5	99.8	99.8

*the percentage unaccounted for represents the students observed in the hall.

Table 3

PREDOMINANT CATEGORIES OF BEHAVIOR

Category	Pre-Change		Post-Change	
	N	% of Total Activity	N	% of Total Activity
Looking at people	198	14.4	177	12.4
Communication	135	9.8	172	12.1
Reading	135	9.8	112	7.8
Arts and crafts	103	7.5	127	8.9
Helping	102	7.4	77	5.4
Writing	85	6.2	101	7.1
Traffic	79	5.8	72	5.0
Sitting games	74	5.4	164	11.5
Organization	66	4.8	69	4.8
Building	59	4.3	98	6.9
Waiting	53	3.9	39	2.7
Animals	49	3.6	24	1.7
Interact with pring	39	2.8	37	2.6
Creative writing	36	2.6	26	1.8
Fidget	23	1.7	—	—
Large physical activity	22	1.6	—	—
Passive behavior	22	1.6	—	—
Manipulate an object	—	—	37	2.6
		93.2		88.3

Table 4

READING AREA ACTIVITY PROFILE

Category	Pre-Change		Post-Change	
	N*	% of Activity**	N	% of Activity
Reading	94	24.0	84	21.6
Looking at people	81	20.7	48	12.3
Communication	49	12.5	70	18.0
Writing	24	6.1	28	7.2
Traffic	16	4.1	24	6.2
Organization	15	3.8	12	3.1
Interact with print	14	3.6	—	----
Helping	13	3.3	13	3.3
Looking-listening	13	3.3	10	2.6
Arts and crafts	11	2.8	—	----
Sitting games	11	2.8	32	8.2
Large physical activity	10	2.6	—	----
Music/drama	—	----	10	2.6
		89.6		85.1

*Number of times a student was observed engaging in the activity

**Percentage of total activity observed in the reading area

demonstrated vividly that all areas of the room were not being used to full advantage. With such a small room (22' X 32'), it was essential that each area attract its share of the population. In addition, the areas had to be flexible enough to be used for a variety of activities, so that they did not stand empty for long periods of time. The corner, the games area, and the science area were clearly not satisfying either of these requirements. Not only did the three areas have low populations, but examination of their activity profiles revealed that the little activity that did occur in each was confined to only a few categories. For example, one-third of the activity in the science area involved animals. Only two other categories, "communication" (12%) and "looking at people" (9%), occurred there frequently enough to be included in the profile. The games area was used almost entirely for "building" (50%), "traffic" (20%), and "looking at people" (20%). No "reading" or "writing" was ever observed there. The corner was used for "writing (12%), "helping" (14%), "sitting games" (20%), and "looking at people" (20%).

Furthermore, the science and games areas were obviously avoided by girls in particular. Although the reasons for this were not entirely clear, comments made during the pre-change interviews suggested that the girls disliked the physical arrangement of the games and science areas, rather than having a lack of interest in the games or science materials themselves. The girls specifically objected to having to sit on the floor in the games area and to the messiness of the science area. In the light of all these considerations, the investigator concluded that the areas of the room with particularly low population frequencies needed to be redesigned to increase their attractiveness and flexibility.

Secondly, the list of predominant categories of behavior indicated that the children were not using the manipulative materials and equipment in the room to any great extent, despite the fact that this was one of the

teacher's major goals. "Manipulating an object" was observed only eight times (0.6%). Likewise, "looking at an item" was observed 13 times (0.9%). "Siting games" and "animals," although included in the list of predominant activities, only occurred 5.4% and 3.6% of the time. Anecdotal information recorded in between formal observations noted that the children were rarely seen using any of the math or science materials except when the teacher directly encouraged them to do so.

This problem was particularly distressing to the teacher. She felt that in a classroom where the teacher did not function as the sole director of activities, but tried to encourage children to initiate activities on their own, it was necessary to have the materials attract and engage the students' attention. The teacher and the investigator concluded that more shelving was necessary in order to display and store materials efficiently and attractively, and that all such shelving had to be prominent and easily accessible.

A third problem specifically concerned the reading area. This space had to be large enough for the entire group to meet comfortably. Yet the teacher also wished to have it serve as a quiet, cozy place which would inhibit distraction and movement and encourage concentration. The activity profile indicated that a great deal of "looking at people" (20.7%) occurred there, as well as more "communication"(12.5%) and more "traffic" (4%) than the teacher would have liked. In addition, it seemed ironic that "large physical activity" (2.6%) was observed there more frequently than in any other area.

Anecdotal records and photographs also attested to the fact that the children in the reading area were lacking a convenient surface on which to write. They had to lean on books, on other chairs, or on the floor. This was possibly the reason for the relatively small amount of

"writing" (6%) which occurred there.

These observations led to the conclusion that while the large size of the area needed to be retained, the space had to be broken up in a way that would cut down on distraction and create the impression of a smaller, cozier place.

After these and other more minor problems were identified and discussed, the experimenter decided on the room changes that were to be made. Three overall goals were to encourage the use of areas that were infrequently visited, to increase their flexibility, and to facilitate the manipulation of curriculum materials. Because of both financial and time restrictions, alterations had to be relatively simple and inexpensive. Among the major changes was the addition of a small, cardboard "house" to the corner, which replaced the table and desk located there. It was hoped that this house would provide a distinctly quiet, private place not existing elsewhere in the room, and would thus lead to increased use of this area. The teacher's filing cabinet was also moved to this out-of-the-way corner. In the science area extensive shelving was built on which materials could be clearly displayed. In the games area, a low platform, table and stools provided surfaces on which to play games or write. Shelving was also added here for the storage of board games. In the reading area, a raised platform and carrels for individual study were added. The children's individual cubby compartments were moved from within the area to the edge where they functioned as a partition between reading and science. Other similar kinds of changes were made in the other areas.

The experimenter then formulated the following hypotheses:

1) changes in the internal design of the areas would lead to a shift in the population distribution toward the ideal; specifically,

a) the science area, the games area, and the corner would be used more frequently;
b) the math area would be used less frequently;

2) an increased number of different types of activities would occur in the science and games areas;

3) more girls would use the science and games areas;

4) there would be an increase in the frequency of the categories "manipulating an object," "sitting games," and "building;"

5) in the reading area, there would be a decrease in the frequency of the categories "looking at people," "communication," "large physical activity," and "traffic," and an increase in writing behavior (the categories "writing" plus "creative writing").

Post-Change Results

Columns 4 and 5 of Table 1 present the post-change population frequencies for each area. Because the sizes of some of the areas changed slightly, a new ideal distribution was derived, which appears in Column 6. This distribution, however, did not seem entirely realistic, for once the furniture in the file area had been removed, this area was expected to function almost entirely as a traffic lane. Thus, a revised distribution was calculated, using for the file area the amount of traffic observed there before the change (2%). The remaining percentage was reapportioned to the other areas on the basis of their size. This recalculated distribution appears in the last column.

Comparison of the pre-change and post-change percentages reveals that the distribution of students across the room has shifted considerably. The numbers of students using the reading area and the corner are extremely similar to the pre-change figures, but the games area—now the second most popular area—and the art, math, and science areas now have almost equal shares of the class population. The file area is used less than half as much as it had been. The observed frequency distribution is clearly closer to the ideal distribution than before the change, and

extremely similar to the re-calculated ideal (see Figure 3). The statistical analysis of this shift will be discussed below.

Columns 3 and 4 of Table 2 list the percentages of males and females attending each area. As predicted, the use of the games and science areas by girls did increase; this was accompanied by a dramatic decrease in their use of the math area. The number of boys using the games and science areas also increased by approximately the same amount.

The predominant activities occurring across all areas of the room are listed in the third and fourth columns of Table 3. If the pre- and post-change figures are compared, a remarkable stability of behavior can be seen. Of the 17 categories appearing in the pre-change list, 14 appear after the change. Only "fidget," "large physical activity," and "passive behavior" do not reappear in this list. Only one new category, "manipulating an object," has been added. In addition, examination of the pre- and post-change percentages of each category reveals relatively small differences in the frequency of occurrence, except for "sitting games," which more than doubled, and "animals," which decreased by more than one-half.

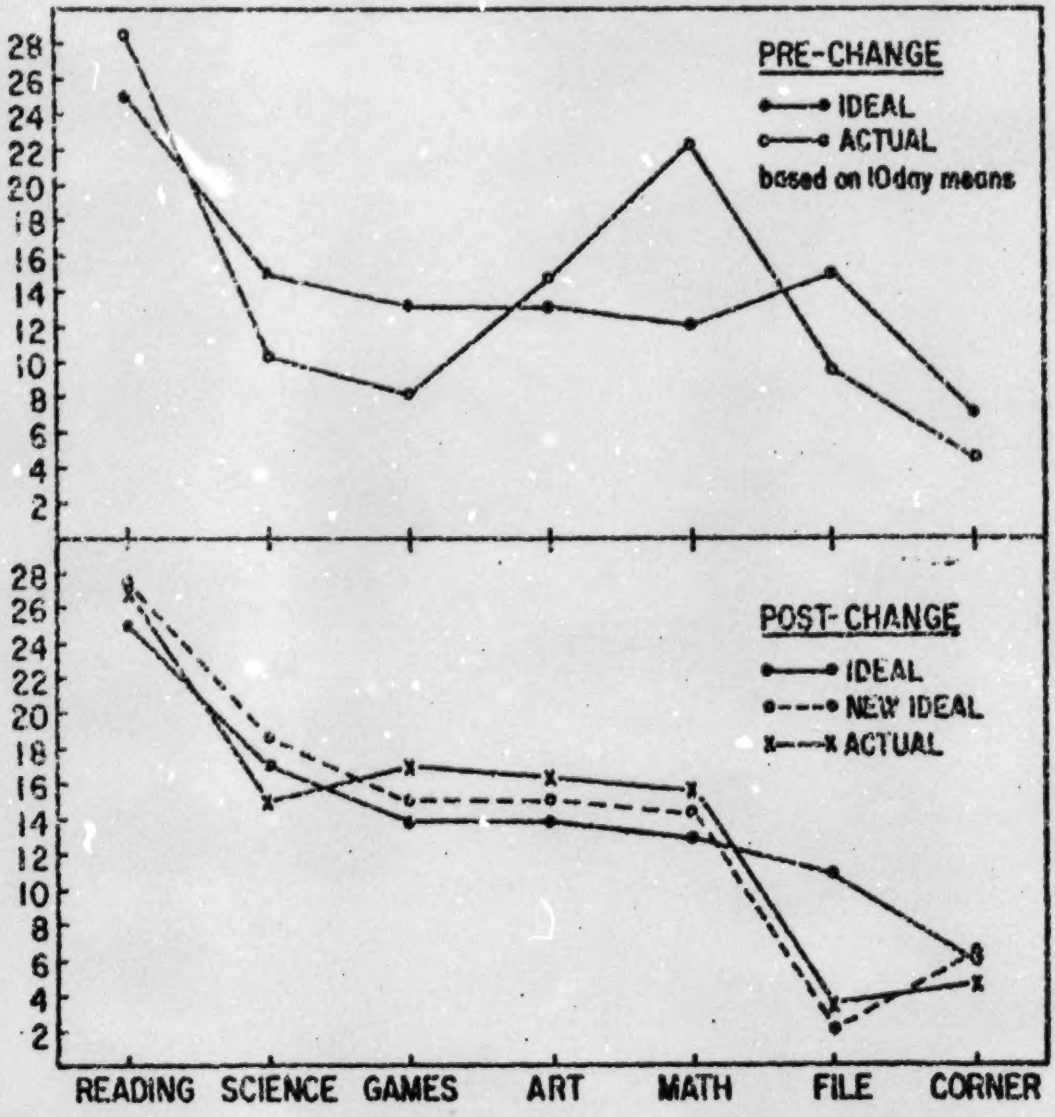
The post-change activity profile for the reading area is presented in Columns 3 and 4 of Table 4.

Statistical Analysis

The data gathered in an experiment like this one have characteristics which make an appropriate statistical test especially difficult to find. In an open classroom, where children have considerable freedom to move about and to choose their activities, an obvious dependency exists among the subjects. If Students A and B are friends, for example, decisions regarding where to work and what to do are often made jointly.

Furthermore, in an experimental design that calls for repeated observations of the same children, there may be dependency across time

FIG. 3 ACTUAL VS. IDEAL POPULATION DISTRIBUTIONS, PRE- AND POST-CHANGE.



(see Harris, 1967). Student A's behavior during the first observation of the day may influence his behavior during subsequent observations. If at 9:00 he is found reading in a quiet corner, totally engrossed in his book, he might be expected to be there one-half hour later at the next observation.

In addition, it is likely that the activities of the class one day affect what occurs the next day. A flurry of creative writing on Monday, for instance, initiated by a filmstrip on Haiku, may lead to even more poetic attempts on Tuesday (positive carry-over) or it may result in a class of satiated writers who consciously avoid poetry for the next few days (negative carry-over).

This combination of dependency among subjects and over time led to the decision to use time-series techniques (Box and Jenkins, 1970; Nelson, 1973) to analyze the differences between the pre- and post-change data. Although used frequently in economic forecasting, this type of analysis is not often employed in educational research. However, time-series seems to be particularly appropriate when the inability to assume independence of subjects necessitates dealing with the group as a whole, and when repeated measurements on the same group create the likelihood of dependency across time. One further advantage of time-series analysis is that it can distinguish a real change due to the intervention from an apparent change due to a steady trend.

In general, the idea behind time-series is to build a model which describes how one day influences the next, or in other words, to explain how the "carry-over" process actually works. It uses the knowledge of this influence to make a more accurate judgment about the significance of an observed difference in behavior.

The outcome of the calculations is not a single value of the *t* statistic. Instead, the analysis examines different amounts of carry-over, from no carry-over to complete carry-over, seeking the value which best describes the data. For each value, it gives the probability that this is the actual amount of carry-over and calculates *t*. Although it is not perfectly clear which *t* value to use to judge significance, the results reported here refer to the *t* values associated with the "most probable" carry-over value (Glass, Willson, and Gottman, 1972).

The results of the calculations are presented in Table 5. With the exception of a few hypotheses, primarily those predicting changes in the reading area, expectations were confirmed.

Discussion

Despite increasing concern with the physical aspects of classroom life, the present investigation is apparently the only existing study of a classroom to attempt an actual intervention and to demonstrate that a change in classroom layout can affect student behavior. This is undoubtedly its primary contribution.

A second unique feature of the study is its use of time-series analysis. Since only one classroom was observed, the possibility exists that the behavioral changes were caused by factors other than the intervention, such as history or maturation. However, the use of time series, which is a rather stringent procedure, plus the fact that specific predicted changes occurred against a background of relative stability of behavior, make these alternative explanations unlikely. Although time-series techniques are extremely complicated, they appear to have great potential for educational research, where the focus of observation is often classroom behavior, involving repeated observations on interdependent subjects.

Table 5

TIME SERIES TESTS FOR SIGNIFICANCE

Hypotheses	t[a]
Shift in distribution across the room towards the ideal; specifically	
1. increase in science area population	4.26**
2. increase in games area population	4.37**
3. increase in corner population	no change
4. decrease in math area population	3.39**
Increase in the number of different types of activities occurring in the	
1. science area	2.35*
2. games area	1.81*
Increase in number of girls using the	
1. science area	1.81*
2. games area	6.78**
Increase in the categories of	
1. manipulating objects	2.94**
2. sitting games	2.00*
3. building	1.16
In the reading area, decrease in categories of	
1. looking at people	2.03*
2. communication	increase
3. large physical activity	numbers too small
4. traffic	increase
In the reading area, increase in	
1. writing activity	no change

[a] $df=13$

*$p < .05$ (one-tailed test)

**$p < .01$ (one-tailed test)

In addition to the goal of examining the environment-behavior relationship, a major objective was the development of a methodology suitable for investigating this interaction in an open classroom. The category system and the observation techniques devised are relatively easy to master and have good inter-observer reliability. They focus on behaviors that have meaning and relevance for the classroom teacher, and although the approach emphasizes patterns demonstrated by the class as a whole, the identities of individual children are not lost. Furthermore, the kind of data generated are easily analyzed in a descriptive fashion by the use of one- and two-way frequency distributions.

Another advantage of the methodology is that it can be easily modified for use by teachers themselves. In cases where teachers were primarily interested in students' locations, the category system could be vastly simplified, or eliminated altogether. The time-samplings would then be used to indicate only which areas of the room were being used fully and which were being avoided.

Beyond the stated objectives of the study, there was an additional, unexpected outcome. The experimenter's continual presence in the school evoked the curiosity of several faculty members, who eventually became intrigued by the topic of the study and followed its progress with interest. From their frequent visits to the room and from faculty room talk, it became clear that the study had focused their attention on the importance of the physical environment. From this perspective, studies such as this can be viewed as potentially valuable change agents in the public schools.

The present investigation strongly supports the position that the physical setting of a classroom can influence students' behavior. In a very real sense, the arrangement of furniture, materials, and equipment

can hinder or facilitate the realization of a teacher's instructional goals. It is essential for teachers to consider the classroom space as well as the curriculum and the interpersonal climate. All play an important role in the establishment of an optimal learning environment.

Footnotes

[1]This article is based upon the author's doctoral dissertation, which was completed at Harvard Graduate School of Education under the direction of Courtney Cazden. The research was supported by a grant from the Harvard Milton Fund. The valuable assistance provided by Molly Potter, Anita Olds, and David Purpel is gratefully acknowledged. The author also wishes to thank Gene Glass and Maxine Wolfe for their contributions, and the principal, teachers and students at Parmenter School in Arlington, Massachusetts, for their cooperation.

[2]The experimenter chose to observe on a fixed schedule, rather than by sampling time randomly for several reasons, both pragmatic and theoretical. First, a certain amount of time in between observations was required for the experimenter to record relevant information and to catch her breath. A random sample of times might have called for a number of observations to be crowded into an impossibly short period, while long periods of the day might have remained unobserved. Second, a fixed schedule allowed for the greatest possible number of observations per day. Third, the fixed timetable meant that the observations each day were more nearly equivalent, thus reducing the variance. Finally, standard times enabled the experimenter to compare the pre- and post-change behavior by time of day. These advantages seemed to outweigh the disadvantages of not sampling all time periods with equal probability, although the results might be somewhat biased since only the particular times in the schedule were represented.

References

Box, G. E. P., & Jenkins, G. M. Time series analysis, forecasting and control. San Francisco: Holden-Day, Inc., 1970.

Brookes, M. J., & Kaplan, A. The office environment: space planning and affective behavior. Human Factors, 1972, 14(5), 373-391.

Eastman, C. M., & Harper, J. A study of proxemic behavior—toward a predictive model. Environment and Behavior, 1971, 3(4), 418-437.

Esser, A. H., Chamberlain, A. S., Chapple, E. D., & Kline, M. S. Territoriality of patients on a research ward. In H. M. Proshansky, W. H. Ittelson, & L. G. Rivlin (Eds.), Environmental psychology: man and his physical setting. New York: Holt, Rinehart, & Winston, Inc., 1970.

Glass, G. V., Willson, V. L., & Gottman, J. M. Design and analysis of time-series experiments. University of Colorado: Laboratory of Educational Research, 1972.

Griffit, W., & Veitch, R. Hot and crowded: influence of population density and temperature on interpersonal affective behavior. Journal of Personality and Social Psychology, 1971, 17, 92-98.

Gump, P. V., & James, E. V. Patient behavior in wards of traditional and modern design. Midwest Psychological Field Station, University of Kansas, Lawrence, 1970.

Hahn, R. R. Behavioral evaluation of a juvenile treatment center: case study of a planning methodology. In W. F. E. Preiser (Ed.), Environmental design research, (Vol. 1), Stroudsburg, Pennsylvania: Dowden, Hutchinson, & Ross, Inc., 1973.

Harris, C. W. (Ed.). Problems in measuring change. Madison, Wisconsin: University of Wisconsin Press, 1963.

Heilweill, M. The influence of dormitory architecture on resident behavior. Environment and Behavior, 1973, 5, 377-412.

Ittelson, W., Proshansky, H., & Rivlin, L. The environmental psychology of the psychiatric ward. In H. M. Proshansky, W. H. Ittelson, & L. G. Rivlin (Eds.), Environmental psychology: man and his physical setting. New York: Holt, Rinehart, & Winston, Inc., 1970.

Karmel, L. J. Effects of windowless classroom environment on high school students. Perceptual and Motor Skills, 1965, 20, 277-278.

Kritchevsky, S., & Prescott, E. Planning environments for young children: physical space. Washington, D. C.: National Association for the Education of Young Children, 1969.

Maslow, A. H., & Mintz, N. L. The effects of aesthetic surroundings: I. Journal of Psychology, 1956, 41, 247-254.

Mintz, N. L. Effects of esthetic surroundings: II. Prolonged and repeated experience in a "beautiful" and an "ugly" room. Journal of Psychology, 1956, 41, 459-466.

Myers, T. I., Johnson, E., III, & Smith, S. Subjective stress and affect states as a function of sensory deprivation. Proceedings of the 76th Annual Convention of the American Psychological Association, 1968, 3, 623-624.

Nelson, C. R. Applied time series analysis for managerial forecasting. San Francisco: Holden-Day, Inc., 1973.

Prescott, E., Jones, E., and Kritchevsky, S. Group day care as a child rearing environment: an observational study of day care programs. Pasadena, California: Pacific Oaks College, 1967. (ERIC Document Reproduction Service No. ED 024-453).

Rivlin, L., & Wolfe, M. The early history of a psychiatric hospital for children: expectations and reality. Environment and Behavior, 1972, 4(1), 33-72.

Rohles, F. H. Environmental psychology: a bucket of worms. Psychology Today, 1967, 1(2), 54-62.

Sommer, R. The ecology of privacy. Library Quarterly, 1966, 36, 234-238.

Sommer, R. Personal space: the behavioral basis of design. Englewood Cliffs, New Jersey: Prentice-Hall, 1969.

Sommer, R., & Ross, H. Social interaction on a geriatric ward. International Journal of Social Psychiatry, 1958, 4, 128-133.

Wohlwill, J. F. The emerging discipline of environmental psychology. American Psychologist, 1970, 25(4), 303-312.

Zifferblatt, S. M. Architecture and human behavior: toward increased understanding of a functional relationship. Educational Technology, 1972, 12(8), 54-57.